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Absence of the Eurasian Griffon (*Gyps fulvus*) in Northern Morocco

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The Eurasian Griffon (*Gyps fulvus*) is a Palearctic species distributed from North Africa, south and southeastern Europe to the Middle East into southwestern and central Asia (Cramp and Simmons, 1980, del Hoyo et al. 1994). In the last three decades the Spanish population has greatly increased (SEO BirdLife 1981, Arroyo et al. 1990, del Moral and Martí 2001). Migration of the species into Africa through the Strait of Gibraltar to Morocco and countries south of Sahara has been studied for a long time (Elósegui and Elósegui 1977, Bernis 1983, Alonso 1984, Griesinger 1998). However, there is limited recent information on the status of the species in Morocco. The information available only describes breeding colonies documented in the past (Soto 1986, Bergier 1987). Mundy et al. (1992) referred to some colonies in the Rif Mountains close to Tangier and additional ones from Figuig in the east to Goulimine on the west of the Anti-Atlas, with no breeding places in the Sahara Mountains. According to Haddane (1996) and others, the distribution of griffons in Morocco has been reduced drastically by human activities, and generally recent information (Mundy 2000, Thévenot et al. 2003) was not supported with fieldwork. The extent of the population decline of griffons and their winter distribution in Morocco remain unknown. Our aim here is to: (1) survey for the Eurasian Griffon breeding colonies in northern Morocco and (2) analyze the recoveries of ringed birds from Spain to identify potential wintering grounds. The status of the species in Morocco is relevant to its conservation. All migrating western European vultures cross through this country before reaching wintering grounds in the southern Sahara.

Study Area and Methods

This study was done in northern Morocco, from the North Atlantic Coast (60 km north of Kénitra) to the eastern Sahara Desert (Plateau du Rekkam) through the Rif (Ouazzane-Chefchauoen-Ketama-Midar to Oujda) and the Middle Atlas Mountains (from Meknès to Taza), and from Guercif into Aïn-Benimathar south as far as Bouarfa, near Figuig. The southernmost surveyed point in central Morocco was Meknès. The study area is similar to the Spanish side of the Strait of Gibraltar from the ecological and geological points of view (Valdés 1991) Many large limestone mountains provide cliffs with suitable caves and surfaces for Eurasian Griffons to breed (del Hoyo et al. 1994). On the Spanish side, one of the largest breeding subpopulations in Spain was found (del Junco and Barcell 1997, del Moral and Martí 2001). However, on the Moroccan side there were breeding colonies only in the past (Soto 1986, Bergier 1987, Thévenot et al. 2003). Some authors believe that griffons may still breed there in Morocco, but the whole area has been heavily populated and hence changed dramatically (Haddane 1996).

Roadside counts covering ca. 2800 km were done during one entire month (1–28 February 2002). On those dates, adult Eurasian Griffons are breeding (laying or incubating) and non-adult migrating birds should still be on their wintering grounds (del Hoyo et al. 1994, pers obs.). Our survey was done using a vehicle, at a speed of ca. 40–50 km/h with stops when colonies were located We looked for cliffs with raptor excrement (white wash), as well as perched and flying vultures (Fuller and Mosher 1981, Donázar et al. 1993). We searched for griffons at any suitable cliff within view of our road surveys and at potential feeding sites such as rubbish dumps or places where livestock carcasses were dumped. During surveys, we used 10 × 40 binoculars and a 20–45× scope. We assumed that our detection probability of the birds from

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the road survey routes was very high. Detection of griffons is highly likely due to their large size and their flocking behavior in diffuse groups (Donázar 1993). We also included supplementary information collected at other sites during short-term visits throughout the typical breeding season (January–June).

Additionally, we made 55 inquiries to local people who were familiar with the species, managers of the Moroccan Environment Agency, and foreign ornithologists with a good knowledge of birds in Morocco. Photographs of both perched and flying griffons were shown to local individuals to help determine if they had seen these vultures. We also asked if these local residents knew of breeding colonies, if they had seen griffons on a year-round basis, and if so, when, where, and how many birds they had seen. Also, we inquired about the attitude of people toward griffons and other raptors.

Finally, to complete our assessment of Eurasian Griffon status in Morocco we examined all the recoveries of birds ringed in Spain from 1965–2002. The following databases were reviewed: Centro de Migración de Aves (SEO/BirdLife), Dirección General de Conservación de la Naturaleza (DGCN) from the Spanish Ministry of Environment, and Museo de Ciencias Aranzadi from San Sebastián.

RESULTS

We did not see any griffons during the roadside census or breeding at any previously-reported colonies. We searched for colonies, but found none in the Jebel Moussa in Tangier region, the Jebel Bouhachen Nature Reserve, and Jebel Haouz (Soto 1986). We surveyed Bab Taza, visiting Tissouka, Lahkraa, Jebel el-Kelaa, Jebel Abdoune, and Talambote, as well as the Oued Laou canyons. We also passed through Talaseemtane National Park and the Ketama (Jebel Tidiquim) Mountains surrounding de Targuist and Al-Hoceima National Park, close to the coast. In addition, we visited the Middle Atlas at Tazzeka National Park. Other colonies mentioned by Soto (1986) and visited with negative results were Bou Bgar (Gorges de la Moulouya), nearby Oujda city. Furthermore, two recorded colonies in Massif des Beni Snassen had no griffons. Our lack of detections suggests that there were neither breeding nor wandering birds in the study area. During our roadside counts we easily detected several cliff-nesting raptors such as Bonelli's Eagles (*Hieraaetus fasciatus*), Peregrine Falcons (*Falco peregrinus*), and Golden Eagles (*Aquila chrysaetos*), all more difficult to detect than Eurasian Griffons. Therefore, we believe that we did not overlook the latter species. Two rubbish dumps were visited, one south of Tangier and another close to Chefchaouèn to the east. None of these seemed to support griffons, although there were large numbers of White Storks (*Ciconia ciconia*). Our previous visits to Morocco had revealed no griffons in the L'Oum or Rbia and El Menzel colonies in 1986 and 1994, respectively.

Of 55 questionnaires, only 50 were judged to provide valid information. Based on their reports, 26 respondents observed Eurasian Griffons in the last decade, 24 within the study area, plus one in the eastern desert and another in the Atlas Mountains (Fig. 1). All were made on the Mediterranean side of Morocco and in the Rif Mountains. People interviewed said that groups of vultures were never seen for long periods. The mean group size was 6.5 ± 6.2 (SD) griffons (range = 1–73). Furthermore, no information was reported on recent breeding colonies. Only one record involved griffons feeding on a carcass near Tangier. Observations were sparsely distributed throughout the year: five in winter (December–February), seven in spring (March–May), four in summer (June–August), and three in autumn (September–November). Observers provided six records (20.8%) for which they could not recall the season. Everyone interviewed pointed out that griffons, as well as other raptors, were shot and even consumed by man. Moreover, five older residents remembered the species from their youth, when wild ungulates and big felids, such as lions (*Panthera leo*) or leopards (*Panthera pardus*), inhabited the area. These individuals reported that griffons were present in the 1960s and 1970s. Finally, one observer reported six griffons in the Middle Atlas Mountains (near Azrou), although he was unable to recall the date and if they were migrant or resident. Bedouin shepherds indicated that every winter a small griffon population remains in the desert located in the Eastern Atlas Mountains, where there is a winter food supply from sheep carcasses.

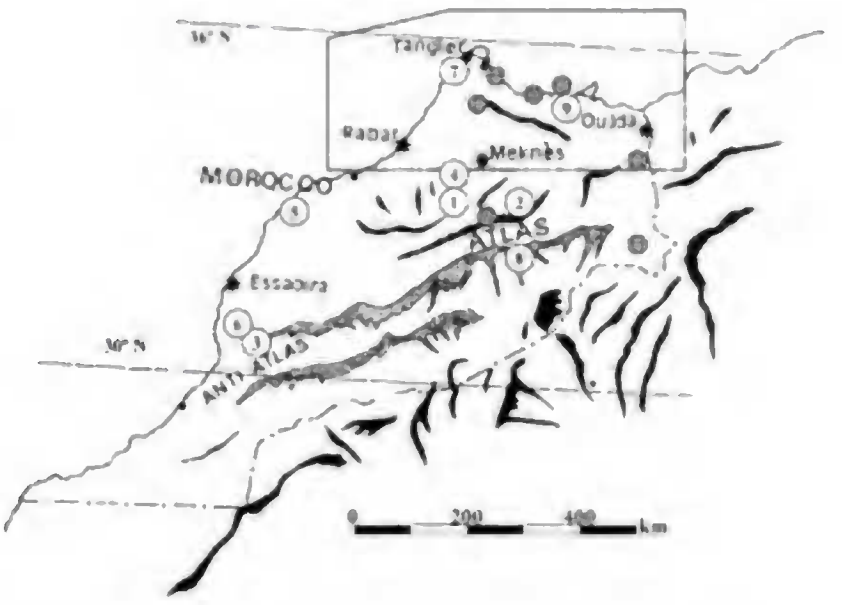

Figure 1. Map of Morocco showing the recoveries of Griffon Vultures ringed in Spain (numbers as in Table 1) and locations of reported observations of griffons (●). The study area in northern Morocco is outlined.

We found only nine recoveries of Spanish ringed griffons in different locations of Morocco (Fig. 1 and Table 1). Most of them (except recoveries 8 and 9) were ringed as nestlings, but all were probably ringed as juvenile birds. Where information was available, most of the deaths were attributed to malnutrition (Table 1). Three had died recently, two were sighted alive, and a sixth griffon was maintained in captivity. It is noteworthy that all

Table 1. Recoveries of ringed Eurasian Griffons in Morocco. Dates (ca. dates are in parentheses), coordinates of ringing and recovery are also shown.

RECOVERY NUMBER	AGE OF RINGING	DATE OF RINGING	COORDINATES OF RINGING	PROVINCE OF RINGING	CIRCUMSTANCES OF RECOVERY	DATE OF RECOVERY	COORDINATES OF RECOVERY	LOCATION OF RECOVERY
1	Nestling	25 Jun 67	42.55N 01.51W	Navarra	Captured	02 Nov 70	33.47N 06.02W	Souk Khemis Ait Yadine
2	Nestling	19 May 71	42.38N 00.49W	Huesca	na	01 Dec 72	33.16N 05.05W	Timandite
3	Nestling	12 May 79	40.56N 00.15W	Teruel	Corpse alone found	02 Oct 80	30.29N 08.52W	Taroudant
4	Nestling	29 May 84	36.35N 05.50W	Cádiz	na	29 Nov 84	33.50N 06.03W	Khemisset
5	Nestling	11 May 85	41.21N 03.50W	Segovia	Malnutrition	06 Jun 86	33.15N 08.40W	Jorf Lasfar
6	Nestling	10 May 86	41.29N 09.40W	Soria	Predated	06 Jul 87	30.30N 09.40W	Toulgharb
7	Nestling	18 May 96	42.50N 03.06W	Alava	na	24 Feb 98	35.53N 05.19W	Ceuta
8	na	27 Nov 98	37.00N 06.30W	Huelva	na	07 Jan 99	32.16N 04.30W	Rich
9	Fledgling	10 Sep 99	41.34N 03.41W	Burgos	Malnutrition	19 Nov 99	34.57N 03.33W	Midar

nine griffons were ringed in different Spanish provinces. Finally, three were ringed in the 1960s or 1970s, four in the 1980s, and four in the 1990s, with no increases in recoveries despite the increases of both the Spanish population and the number of griffons ringed (del Moral and Martí 2001, Gómez-Manzaneque et al. 2002).

DISCUSSION

Our survey revealed a complete lack of breeding or wintering Eurasian Griffons in northern Morocco. This could reflect the alarming decline of the species reported by Soto (1986) and Thévenot et al. (2003). According to these authors and this current study, the Eurasian Griffon could be extirpated as a breeding species in this region and probably in all of Morocco. Reasons for this decline would be lack of food and direct human persecution by means of poaching and poisoning (Soto 1986, Haddane 1996, Thévenot et al. 2003). The same reasons could explain why there are no vagrant griffons in the area, despite that the physical habitat appears suitable. Results of inquiries indicated that only migrating griffons from Europe passed over northern Morocco, and that no locally-breeding birds were present. Increasing numbers of griffons have been recorded crossing into Africa in recent years with 1633, 2649, and 4816 birds in 1998, 1999, and 2000, respectively (SEO/BirdLife 2001). Furthermore, up to 1524 were recorded at Koudia el Baida (20 km north to Tetouan and 30 km east from Tangier), with 1426 birds counted on 23 October during a survey in 2001 (P. Bergier pers. comm.). To date, the migration period and pattern of griffons has not been analyzed in detail (Bernis 1983, Franchimont and Moumni 1996, Griesinger 1998). Migration phenology in the Strait of Gibraltar area extends even later than October, with large numbers still passing in November (SEO/BirdLife 2001).

Ring recoveries of griffons were scarce and were not adequate to draw any conclusions. Recent studies with Egyptian Vultures (*Neophron percnopterus*) tracked with satellite transmitters (Benítez et al. 2003, M. de la Riva pers. comm.) showed broad-band migration over Morocco and that the birds followed a straight flight path southwards over the country and the Sahara Desert. Limited data for griffons seem to show a similar migration pattern, although it has been suggested that these vultures follow specific routes as they do in Spain (Garrido et al. 2001). Recoveries of griffons on the Atlantic side could suggest a second coastal route or vagrant birds. Migration along this route would likely take griffons to sub-Saharan wintering quarters in Mauritania, Senegal, and Mali (del Hoyo et al. 1994, Layna 1999). A small griffon population could remain in the northern Sahara, if food is available. In addition to Spanish recoveries, there is another from a juvenile griffon ringed in the Pyrenees of France as a nestling in early June 1993 and recovered near Meknès within the same year (5 October; Arthur and Peyrusque 2000) that supports the idea of a central broad-band migration of griffons. The percentage of ring recoveries in Morocco (2.7%) is lower than that in the Iberian Pen-

insula (5.1%), from 4062 griffons ringed in Spain (Gómez-Manzaneque et al. 2002). Probabilities of reporting a ringed bird could be biased relatively high in heavily populated areas, giving a misleading impression of the migration route. Nevertheless, the final destination of griffons should be determined by future studies using satellite transmitters (Camiña, 2004).

From the conservation point of view, our study indicates that the Eurasian Griffon is seriously endangered, if not extinct as a breeding species in Morocco. The decline in the griffon population was probably due to a lack of available food and human persecution. For this reason, we suggest that it is urgent to examine the status of the griffons in Morocco and other African countries south to the Sahara to provide information necessary to implement conservation measures.

Ausencia de *Gyps fulvus* del Norte de Marruecos

Resumen.—Mediante transectos por carretera en el norte de Marruecos (2800 km) y visitas a antiguas colonias de cría, se han buscado evidencias de cría o invernada del buitre *Gyps fulvus*. Además, se han realizado 55 encuestas a habitantes de Marruecos sobre el estatus de la especie. No se ha encontrado ningún buitre criando a pesar del aparente hábitat disponible. Los habitantes de la zona indicaron su presencia en el pasado. La persecución humana puede ser la causa de está disminución. Al menos en el área de estudio la especie esta extinta como nidificante. Las recuperaciones de aves anilladas son escasas y se concentran en tres zonas: el desierto del este, las montañas centrales y la Costa Atlántica de Marruecos. Son necesarias urgentes investigaciones sobre el estado del buitre *G. fulvus* en todo el país.

[Traducción de los autores]

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ARTIFICIAL NEST STRUCTURE USE AND REPRODUCTIVE SUCCESS OF BARN OWLS IN NORTHEASTERN ARKANSAS[1]

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KEY WORDS: *Barn Owl*; Tyto alba pratincola; *artificial nesting structures*; *breeding chronology*; *reproductive success*; *productivity*; *Arkansas*.

Raptor numbers and productivity in some regions are clearly limited by availability of nest sites (Newton 1979). A shortage of nest sites may hold raptor populations at a breeding density below the level that food would otherwise support (Newton 1979). There are two types of evidence in the literature that support this hypothesis: (1) breeding pairs are scarce in areas where nest sites are absent (but which seem otherwise suitable), and (2) the provision of artificial nest sites is often followed by an increase in breeding density (Newton 1979).

Studies done on Barn Owls (*Tyto alba*) in northern Utah by Marti et al. (1979) supports Newton's (1979) proposal concerning the effect of limited nest sites. Marti et al. (1979) suggested that prior to the appearance of buildings, a breeding population of Barn Owls was virtually nonexistent on his study area due to a paucity of suitable nest sites, but that foraging habitat and prey were abundant. At this site, Marti et al. (1979) surveyed ca. 50 silos that were used as roosts by Barn Owls, but only one provided a suitable nest site. In 1977, these workers placed nest boxes in 30 silos before the spring nesting period. By the end of 1978, 24 (80%) of the boxes were used by breeding owls (Marti et al. 1979). Similarly, on oil palm (*Elaeis guineensis*) plantations in Malaysia, Duckett (1991) reported that breeding population densities of the Barn Owl (*T. a. javanica*) were limited by available nest sites, despite high densities of several species of rat (*Rattus* spp.; ca. 250–400/ha). Twenty months after Duckett (1991) erected 200 nest boxes in a 1000 ha mature palm plantation (1 box/5 ha), 95% were occupied by nesting Barn Owls. As a result, rat damage to palm trees on the plantation had dropped by 18.1% from the beginning of the study (Duckett 1991). The studies conducted by Marti et al. (1979) and Duckett (1991) support the hypothesis that Barn Owl populations can be limited by the availability of nest sites.

Bloom and Hawks (1983) recorded similar results by testing nest-site limitation in American Kestrels (*Falco sparverius*) in northern California. Of a total of 208 nest boxes examined between 1977–80, 31% were occupied by breeding kestrels (Bloom and Hawks 1983). Bloom and Hawks (1983) suggested that with more strategic

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